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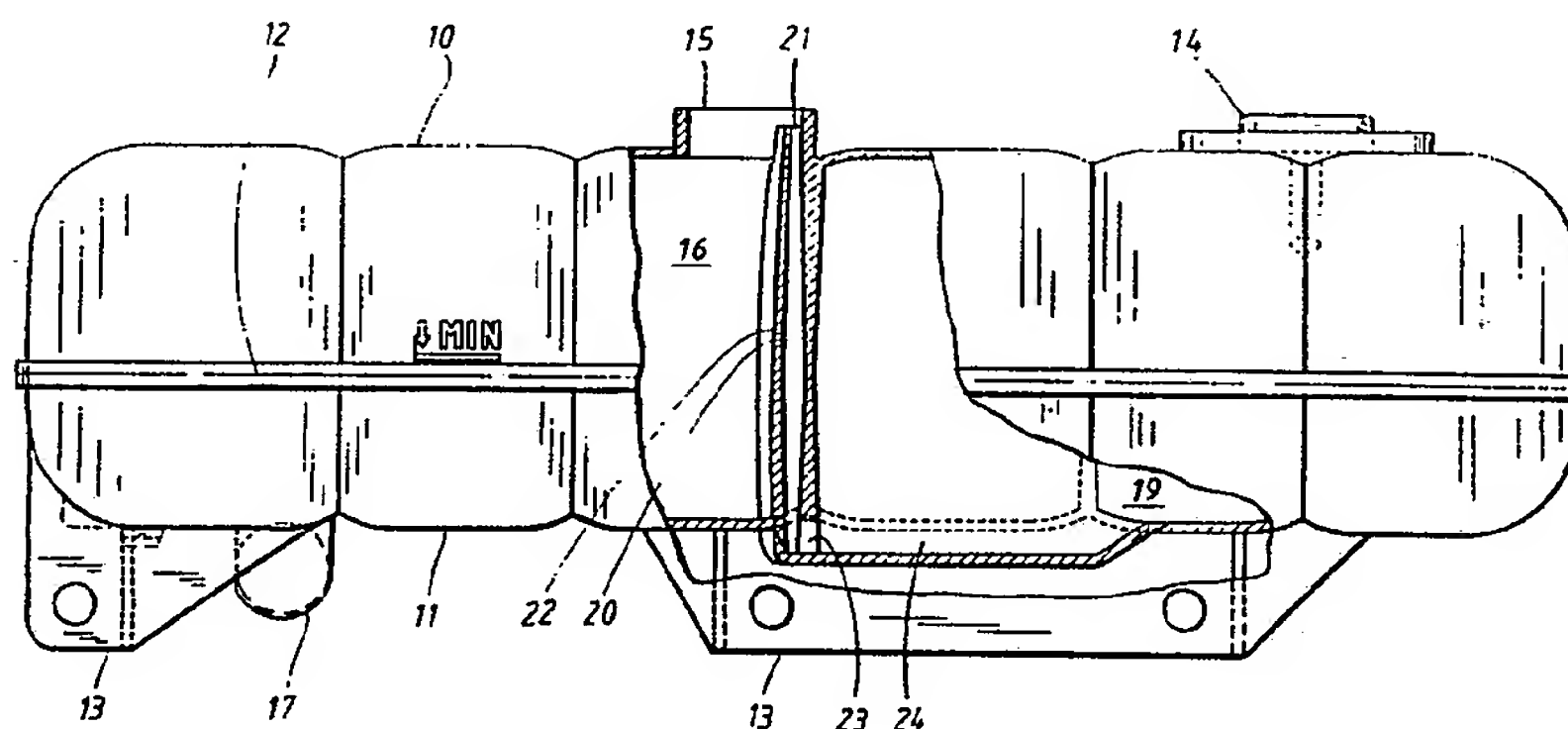
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9102716-9 20 September 1991 (20.09.91) SE(71) Applicant (for all designated States except US): AB VOLVO
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(54) Title: EXPANSION TANK FOR THE COOLING SYSTEM OF AN INTERNAL COMBUSTION ENGINE



(57) Abstract

A combined storage tank (16) and expansion tank (19) arrangement for a water-cooled internal combustion engine cooling system. The storage tank (16) which is provided with a filler opening (15) and the expansion tank (19) are housed in a common container tank made from two moulded plastic parts (10, 11), with the storage tank and expansion tank internally connected via a vertically disposed overflow channel (20). In order to simplify manufacture and aid pressure testing, the overflow channel (20) is integral with and connected to the filler opening (15) of the storage tank.

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5 TITLE:

Expansion tank for the cooling system of an internal combustion engine.

10 TECHNICAL FIELD:

15 The present invention relates to a combined storage tank and expansion tank arrangement for a water-cooled internal combustion engine cooling system, whereby the storage tank which is provided with a filler opening and the expansion tank are housed in a common container tank made from two moulded plastic parts, with the storage tank and expansion tank internally connected via a vertically disposed overflow channel.

20

BACKGROUND OF THE INVENTION:

25 The above-described cooling system with a storage tank for the cooling liquid and a separate expansion tank for the expansion of the liquid during warming-up is used for example on heavier trucks and buses where very high functional safety requirements are imposed.

30 Where the available height is restricted, it has been usual to use separate tanks which are mounted by brackets and connected together by means of tubes and tube clamps. This implies that a relatively large number of components have to be stored and assembled during the production of a vehicle. Since it is desirable to reduce the number of
35 assembly components, combined storage tanks and expansion tanks forming a common container tank are now becoming available. This rationalization is most effective if the

container tank is made from two injection-moulded plastic halves which are welded together to form a finished unit with all necessary functions integrated within the two halves.

5

Such a container tank is shown in DE OS 35 33 095, whereby the storage tank and the expansion tank are connected via a centrally located overflow channel. A disadvantage with this arrangement, i.e. that leakage can arise between the two chambers, has been solved by the provision of a double walled partition wall between the two chambers, whereby infiltration is indicated by leakage of liquid through overflow holes in the double walled cavity.

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15 TECHNICAL PROBLEM:

An object of the present invention is thus to provide a container tank for cooling liquid with minimal installation dimensions, with which the cooling system can be tested in a more reliable manner using pressurized air.

20

SOLUTION:

This object is achieved according to the invention by means of the overflow channel being integral with and connected to the filler opening of the storage tank. By means of this arrangement a hermetical test can be easily performed after affixing a test instrument in the filler opening instead of to the filler cap. In this manner the cooling system can be pressure-tested with the exclusion of the expansion tank. Thereafter the connection to the expansion tank can be opened and the entire system can then be pressure-tested.

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Advantageous embodiments to the invention will be apparent from the dependent claims.

35

BRIEF DESCRIPTION OF THE DRAWINGS:

An embodiment of the invention will now be described in more detail with reference to the attached drawings, in which

Fig. 1 is a side view of a container tank according to the invention with a partially sectioned wall,
Fig. 2 is a corresponding end view of the container tank, and
Fig. 3, 4 show in broken plan views the interior of the cover and base of the container tank.

BEST MODE OF CARRYING OUT THE INVENTION:

The container tank shown in the drawings is assembled from two tank halves 10, 11 with the joint line 12 extending in a horizontal plane. The two halves 10, 11 are suitably made by injection-moulding of a propene plastic and are joined together by heat welding.

The container tank is provided with moulded brackets 13 for direct mounting in the engine compartment of a vehicle and includes two separate chambers, each having an opening 14 and 15. The one chamber 16 forms the storage tank for the cooling liquid in the cooling system and is connected to the not shown cooling system via a base outlet 17 and two breather pipes 18. The other chamber 19 forms an expansion tank for the storage tank 16 and is connected thereto via an overflow channel 20 which extends between the upper portion of the storage tank 16 and the lower portion of the expansion tank 19.

As best shown in Figs. 1 and 2, the overflow channel 20 is in the form of a flattened pipe 22 which extends between an opening 21 in the throat of the filler opening 15 of the

storage tank 16 down to an opening 23 which is located below the level of the bottom of the tank in a narrow trough compartment 24. The compartment 24 further extends upwardly into the container tank between two side walls 25 which, together with the tube 22 and a transverse wall 26, form the partition wall between the storage tank 16 and the expansion tank 19. Further inner longitudinal and transverse walls 27 in the storage tank 16 and the expansion tank 19 serve as anti-surge walls and reinforcement.

When the container tank is functionally connected to the cooling system, the above described overflow channel will then serve as an evacuation path for air from the storage tank to the expansion tank 19. For this purpose the opening 14 to the expansion tank is provided with a special cap which is not shown in the drawings but is well known to the skilled man. Such a cap serves as a back valve, i.e. it prevents reduced pressure from arising within the expansion tank 19 by admitting atmospheric air from outside via a valve passage 28. At the same time the cap prevents air from being evacuated from the container tank except when in an extreme situation the pressure exceeds a predetermined level.

When the temperature in the cooling system rises the volume of the cooling liquid will expand which results in a compression of the air in the expansion tank 19. This compression normally continues until the storage tank 16 is totally emptied of air. This is possible by placing the opening 21 to the overflow channel 20 at a high location in the throat of the filler opening 15. With further heating from the motor, the cooling liquid and air is forced from the storage tank to the expansion tank via the overflow channel 20.

When the temperature in the cooling system drops once again, the volume of the cooling water will reduce. When the pressure drops the cooling liquid in the expansion tank 19 will be drawn/pushed back to the storage tank 16 by means of a siphoning effect via the overflow channel 20. Since the overflow channel 20 opens into a narrow trough at the base of the container tank, the quantity of cooling liquid which cannot be transferred back to the storage tank 16 will be very little. This means that the cooling liquid in the system is utilized to the full.

A hermetical test of the entire cooling system can easily be performed after affixing a test instrument in the filler opening 15 instead of to the filler cap. The test instrument is suitably so shaped that it sealingly abuts both the opening 15 and the opening 21. In this manner the cooling system can be pressure-tested independently of the expansion tank 19. Thereafter a connection to the expansion tank via the opening 21 can be opened and the entire system can then be pressure-tested. If during the first pressure testing the cooling system can withstand a considerably higher pressure than the maximum pressure for the expansion tank, it can be concluded that there is no leakage between the storage tank and the expansion tank. It is therefore very simple to perform a functional test even if the container tank has become opaque due to dirt and ageing.

Although a specific embodiment to the invention has been shown in the drawings it is to be understood that further alternatives and modifications are possible within the scope of the claims.

5 CLAIMS:

1. Combined storage tank (16) and expansion tank (19)
arrangement for a water-cooled internal combustion engine
cooling system, whereby the storage tank (16) which is
10 provided with a filler opening (15) and the expansion tank
(19) are housed in a common container tank made from two
moulded plastic parts (10, 11), with the storage tank and
expansion tank internally connected via a vertically
disposed overflow channel (20), c h a r a c t e -
15 r i z e d in that the overflow channel (20) is integral
with and connected to the filler opening (15) of the
storage tank.

2. Arrangement according to claim 1,
20 c h a r a c t e r i z e d in that the filler opening (15)
is centrally placed on the container tank.

3. Arrangement according to claim 1 or 2,
c h a r a c t e r i z e d in that the lower part of the
25 overflow channel opens out into a trough (24) in the lower
wall of the container tank.

4. Arrangement according to claim 1 or 2,
c h a r a c t e r i z e d in that the upper part of the
30 overflow channel (20) opens out at a level above the upper
wall of the container tank.

5. Arrangement according to claim 1 or 2,
c h a r a c t e r i z e d in that the lower part of the
35 overflow channel opens out into a partitioning delimited by

two vertical walls (25) which extend upwardly on either side of the trough (24).

6. Arrangement according to claim 1 or 2,
5 c h a r a c t e r i z e d in that the filler opening (15)
is formed with an upper primary sealing surface and a
secondary sealing surface arranged therebelow, against
which secondary sealing surface a pressure-testing
10 instrument may be sealingly placed to pressure-test the
storage tank and other parts of the cooling system with the
exception of the expansion tank.

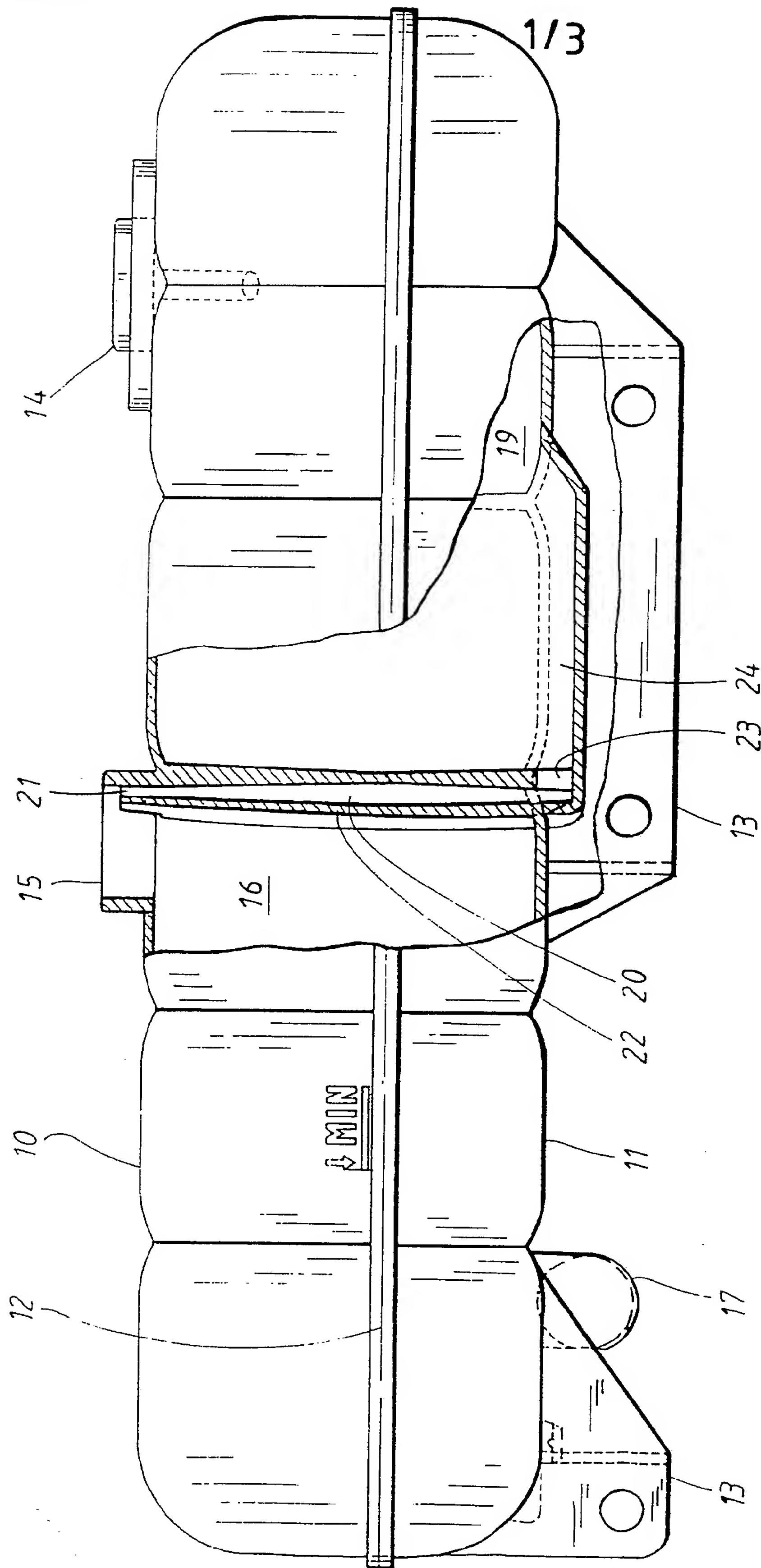


FIG. 1

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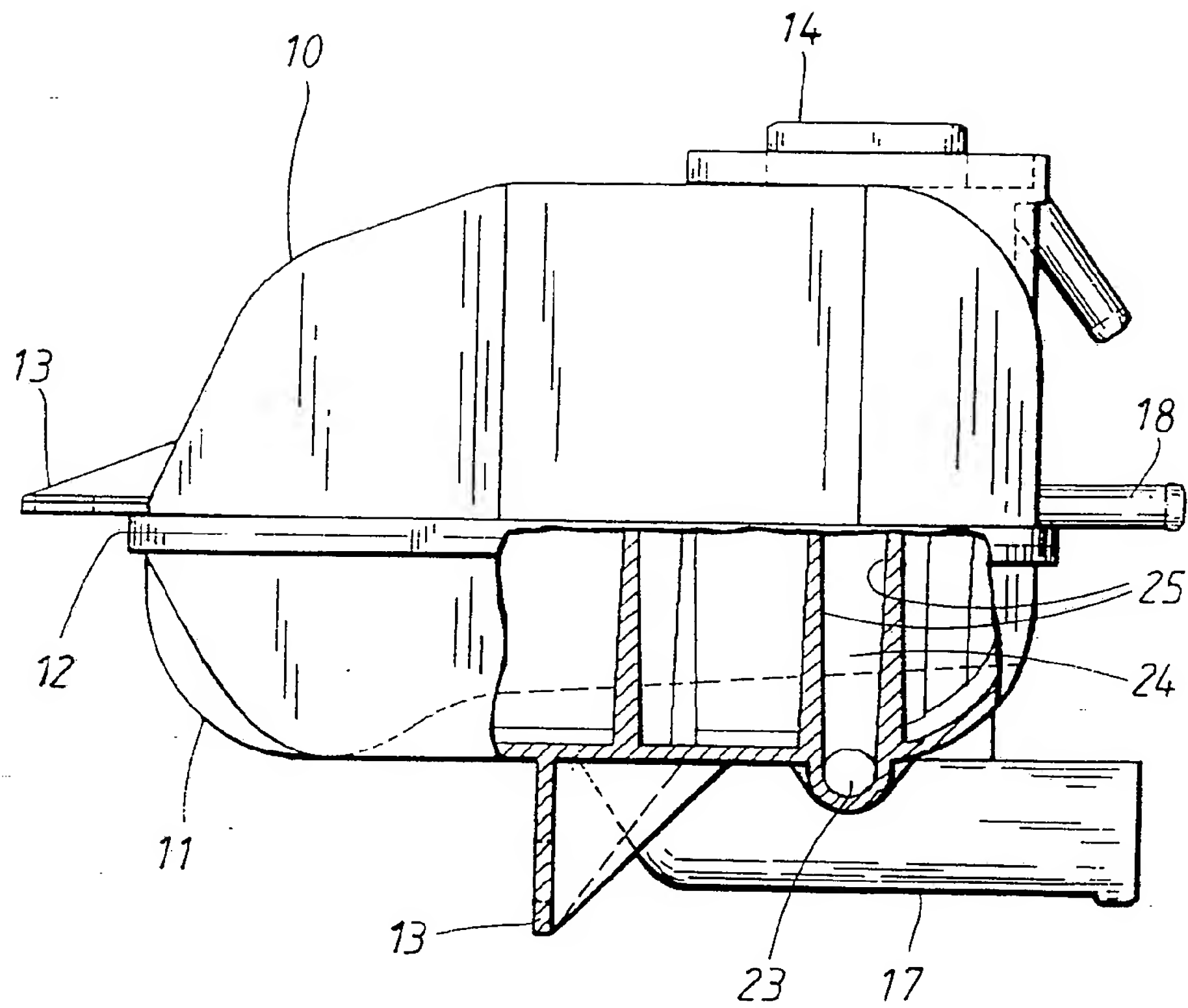
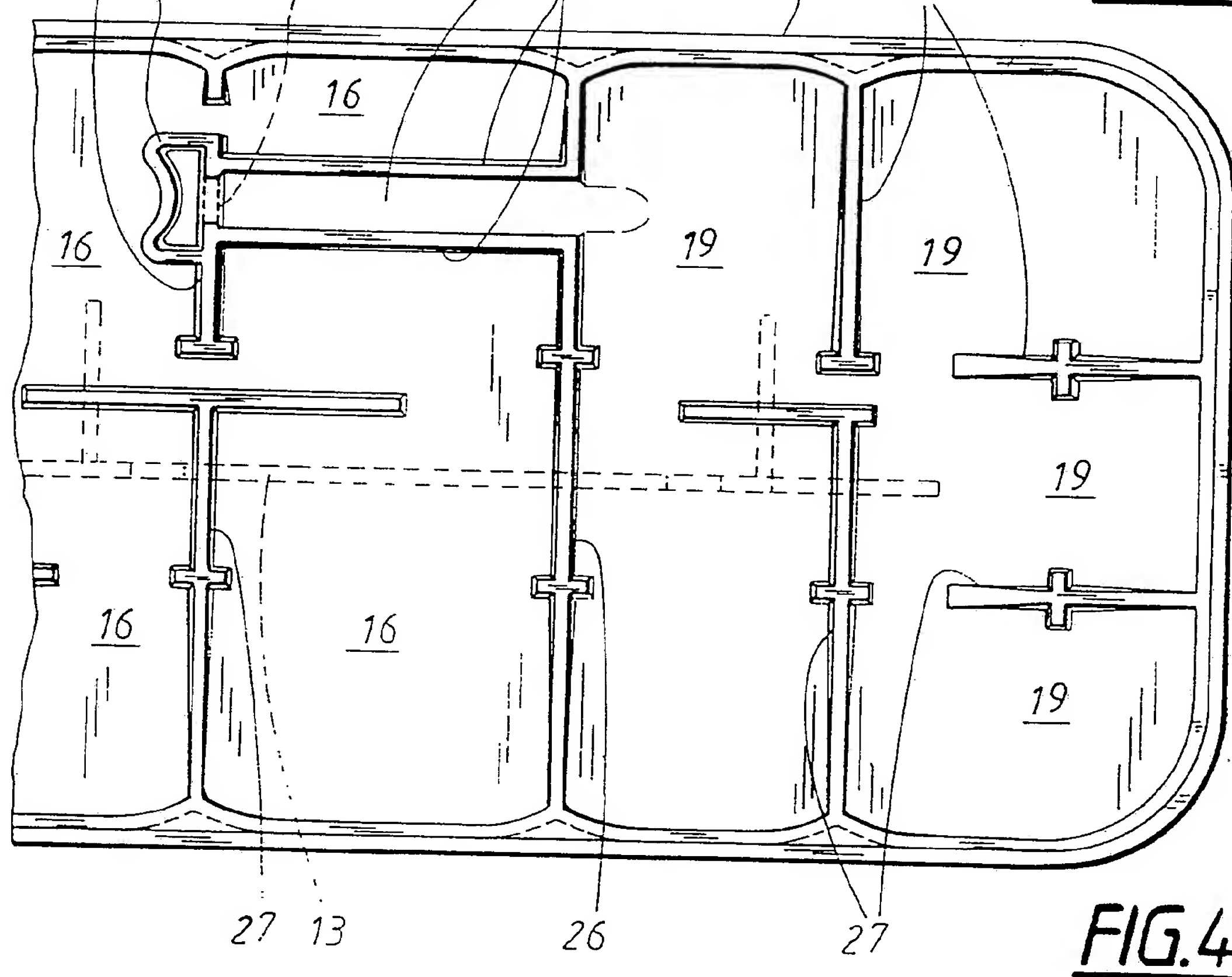
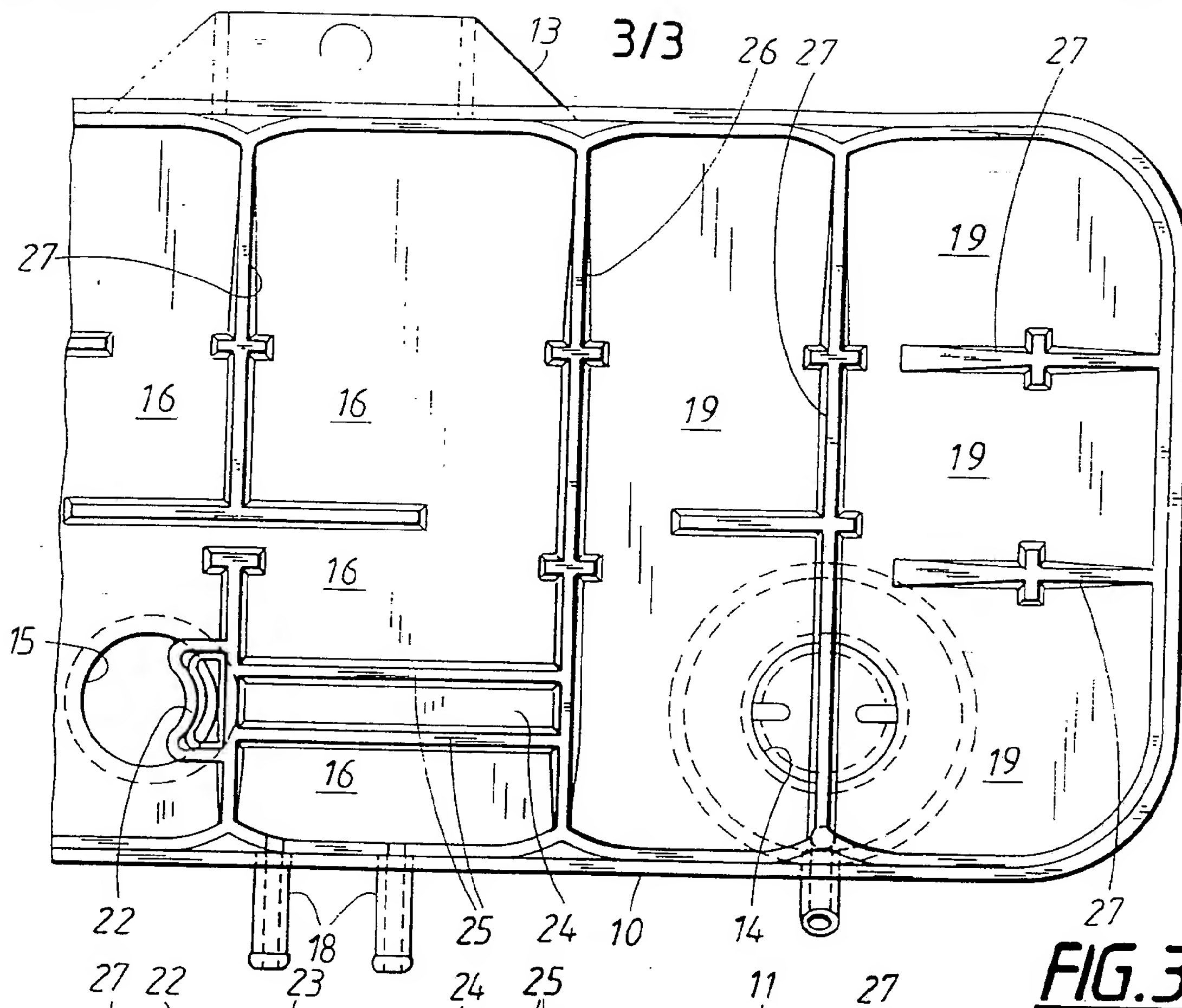


FIG. 2



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 92/00623

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: F 02 P 11/02											
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; border: 1px solid black; text-align: left;">Classification System</th> <th style="width: 75%; border: 1px solid black; text-align: left;">Classification Symbols</th> </tr> <tr> <td style="border: 1px solid black; height: 40px; vertical-align: bottom;">IPC5</td> <td style="border: 1px solid black; height: 40px; vertical-align: bottom;">F 02 P</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸</div> <p style="padding: 5px;">SE,DK,FI,NO classes as above</p>			Classification System	Classification Symbols	IPC5	F 02 P					
Classification System	Classification Symbols										
IPC5	F 02 P										
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; border: 1px solid black;">Category *</th> <th style="width: 70%; border: 1px solid black;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 20%; border: 1px solid black;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td style="border: 1px solid black; text-align: center; vertical-align: top;">A</td> <td style="border: 1px solid black; vertical-align: top;">DE, A1, 3533095 (SÜDDEUTSCHE KÜHLERFABRIK JULIUS FR. BEHR GMBH & CO. KG) 19 March 1987, see figure 1 --</td> <td style="border: 1px solid black; text-align: center; vertical-align: top;">1-6</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; vertical-align: top;">A</td> <td style="border: 1px solid black; vertical-align: top;">DE, A1, 3517715 (KÜHLERFABRIK LÄNGERER & REICH GMBH & CO. KG) 20 November 1986, see figure 1 details 32,33 -- -----</td> <td style="border: 1px solid black; text-align: center; vertical-align: top;">1-6</td> </tr> </tbody> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	DE, A1, 3533095 (SÜDDEUTSCHE KÜHLERFABRIK JULIUS FR. BEHR GMBH & CO. KG) 19 March 1987, see figure 1 --	1-6	A	DE, A1, 3517715 (KÜHLERFABRIK LÄNGERER & REICH GMBH & CO. KG) 20 November 1986, see figure 1 details 32,33 -- -----	1-6
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<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>* Special categories of cited documents:¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 48%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>											
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border: 1px solid black; padding: 5px;"> Date of the Actual Completion of the International Search 23rd December 1992 </td> <td style="width: 50%; border: 1px solid black; padding: 5px;"> Date of Mailing of this International Search Report <div style="text-align: center; font-size: 1.2em;">30 -12- 1992</div> </td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;"> International Searching Authority <div style="text-align: center;">SWEDISH PATENT OFFICE</div> </td> <td style="border: 1px solid black; padding: 5px;"> Signature of Authorized Officer <div style="text-align: center;">Krister Bengtsson</div> </td> </tr> </table>			Date of the Actual Completion of the International Search 23rd December 1992	Date of Mailing of this International Search Report <div style="text-align: center; font-size: 1.2em;">30 -12- 1992</div>	International Searching Authority <div style="text-align: center;">SWEDISH PATENT OFFICE</div>	Signature of Authorized Officer <div style="text-align: center;">Krister Bengtsson</div>					
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 92/00623

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A1- 3533095	87-03-19	EP-A-B- 0215370 US-A- 4739730	87-03-25 88-04-26
DE-A1- 3517715	86-11-20	NONE	